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Shrub Live Oak Control by Root Plowing

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Successful seeding of adapted grasses in the Arizona chaparral depends on control of the competing shrubs. Since subsequent grass production is inversely proportional to shrub canopy (Pond 1961),³ control methods that give high shrub kills are obviously preferred.

Root plowing is a relatively effective and moderately expensive method of controlling shrub live oak (*Quercus turbinella* Greene) on Arizona rangelands. Burning, riling, chaining, and single applications of most herbicides which are used at present may destroy the aboveground parts of plants, but sprouts from the massive root crowns quickly reoccupy the site (Pond and Cable 1960, Lillie 1962, Schmutz and Turner 1957). Some success has been achieved by repeated aerial applications of 2,4,5-T (Schmutz and Whitham 1962, Lillie 1963), basal application of a mixture of 2,4-D and 2,4,5-T in diesel oil (Cable 1957), and heavy applications of substituted urea compounds (Wagle and Schmutz 1963), but at the present stage these treatments are too expensive for widespread control programs.

This paper evaluates the results of root plowing on one site near Prescott, Arizona, and makes recommendations for improving the effectiveness of the method.

Methods

To determine mortality of shrub live oak due to root plowing, 200 clumps, or clusters, of this species were selected on a 300-acre site of dense chaparral scheduled for plowing late in the summer of 1962. These clumps, 100 of them near each of two permanent points, were oriented to those points with a transit and stadia rod so they could be relocated after plowing. The clumps were thought to be individual plants, but excavation of several after plowing revealed that most were closely knit groups of as many as six separately rooted individuals (fig. 1). The canopy spread of each clump was estimated by averaging two cross diameters taken at right angles through the center of the crown.

Results

The clumps with one or more surviving individuals were counted in 1964, 2 years after the site was plowed. These survivors were examined to determine, if possible, why they were not killed.

Root plowing killed 81 of the 100 plants near each point. The stems and branches of most survivors had been cut below the soil surface, but the root crown of one or more of

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³Names and dates in parentheses refer to Literature Cited, page 2.

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Figure 1.--A clump of shrub live oak consisting of six individual plants; the root crowns were missed by shallow plowing 2 years before.

the individuals in the clump was not severed and had sprouted. All plants cut off below the root crown were killed. Successful root plowing depends on completely separating the root crown from the roots.

Many of the survivors were found to be from clumps large in diameter. Around one point, the average pretreatment diameter of the 100 clumps was 5.9 feet. The pretreatment diameter of the 19 clumps having one or more surviving members averaged 6.5 feet. Around the other point, average pretreatment diameter of all clumps was 5.4 feet, and that of the survivors was 5.9 feet. Clumps with large diameters probably contain more individuals than those with small diameters. This means more chance of missing at least one of the individuals with the plow.

The 81 percent kill of shrub live oak clumps could have been higher with more careful plowing. Plants survived root plowing for one of several possible reasons.

Improper plowing depth was one common reason for missed plants (fig. 1). Because shrub live oak root crowns are seldom more than 1 foot below the soil surface, the plow should operate at, or just below, this depth. Plowing at 2 or more feet should be avoided; small plants with shallow root systems can survive if they are not dragged completely out of the soil.

Some plants survived because the plow missed them. Apparently, the operator assumed that all loose or disturbed soil had

already been plowed. Several survivors were found on the narrow unplowed strips, hidden beneath loose soil thrown up along each edge of a swath of plowed roots. Each plowing swath should include the entire width of the adjacent berm cast up by the preceding swath.

Several survivors were found in or near piles of dead brush. These piles were formed when the plow was lifted out of the ground to clear the accumulated debris. The plow evidently did not return to its effective depth for several feet after the debris was removed. These spots could be eliminated if the tractor operator would turn to one side to clear the debris, and then make sure the plow had returned to proper depth before continuing along the swath.

It is impractical to expect every plant to be killed. Some will be missed by the most conscientious tractor operators. If the above suggestions are followed, however, brush control on root-plowed sites should be considerably higher than 81 percent.

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